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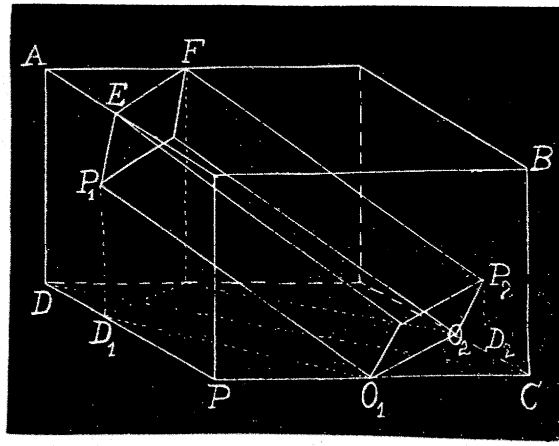
Solution by B. F. BURLESON, Oneida, Castle, New York, and the PROPOSER.

Let $x=AF$, $y=AE$, $z=P_2D_2$, and $l=O_1P_1$=the required length of the inscribed rectangular parallelopiped; then, obuiously, $x^2+y^2=b^2$....(1), $(L-x)^2+(B-y)^2+(H-z)^2=l^2$....(2), $x(L-x)=y(B-y)$.....(3), and $h\sqrt{[(L-x)^2+(B-y)^2]}=lz$....(4). From (3) and (1),

$$4y^4-4By^3+(B^2-4b^2+L^2)y^2+2Bb^2y=(L^2-b^2)b^2$$

....(5); and this with coefficients numerically expressed, becomes

$$4y^4-256y^3+10885y^2+3200y=171600\ \ldots\ldots(6).$$



Therefore, by *Horner's Method of Approximation*, we have from (6), $y=4$; whence $x=3$. Briefly putting the now known $(L-x)^2+(B-y)^2,=m^2=10000$, we have from (2) and (4), respectively, $m^2+(H-z)^2=l^2$....(7), and $lz=hm$....(8). Therefore, $l^4-(H^2+m^2)l^2+2Hhml=h^2m^2$....(9); that is, $l^4-12500l^2+30000l=90000$ ....(10).

Whence $l=110.617130324415$ feet.

COR.—Make $H=0$, and $h=0$; then the problem becomes: *Find the length of a rectangle of given width inscribed diagonally in a given rectangle.*

After performing obvious operations, we obtain $l^4-(B^2+2b^2+L^2)l^2+4BbLl=(B^2-b^2+L^2)b^2$....(11); or with the coefficients numerically expressed, we have the equation,

$$l^4-11035l^2+106240l=274000\ldots.(12).$$

Therefore $l=100$ feet, which is the length of the diagonally-inscribed rectangle required.

A. H. Bell gets 107.5 feet as a result.

42. Proposed by G I. HOPKINS, Instructor in Mathematics and Physics in High School, Manchester, New Hampshire.

If the bisectors of two angles of a triangle are equal the triangle is isosceles.

Solution by the PROPOSER.

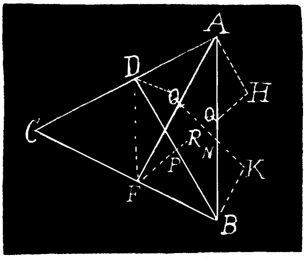
Let AF and BD bisect the angles of the triangle ABC, and let $AF=BD$.

Draw DE. Make $\angle PDO-\angle PDF$, and $\angle QFN=\angle QFD$.

Draw AH perpendicular to AF and BK perpendicular to BD.

Draw FH through O and DK through N.

$\triangle DFB = \angle DOB$, having two angles and included side of one etc. $\therefore$ $BF = BO$. $\therefore$ BP is perpendicular to OF, for a line which bisects the vertical angle of an isosceles triangle is perpendicular to the base. Similarly $AD = AN$, and AQ is perpendicular to ND. $\triangle$'s DPR and FQR are right-angled at P and Q. $\therefore$ $\angle RDP = \angle QFR$. $\therefore$ $\triangle$'s AHF and KBD are equal, since they are right-angled at B and A, and have a leg and adjacent acute angle of one equal respectively to a leg and adjacent acute angle of the other.



$\therefore$ $AH = KB$. BK is parallel to HF, and AH is parallel to KD, being perpendicular to the same line. $\therefore$ $\angle KBN = \angle HOA$, and $\angle KNB = \angle HAO$, being exterior interior angles. $\therefore$ $\angle H = \angle K$.

$\therefore$ $\triangle$'s KNB and HAO are equal, having two angles and included side etc. $\therefore$ $AO = NB$. $\therefore$ $AN = OB$. $\therefore$ $AD = BF$. $\therefore$ $\triangle$ s ADF and BDF are equal, having three sides respectively equal.

$\therefore$ $\angle DAF = \angle DBF$, and $\therefore$ $\angle A = \angle B$. $\therefore$ $AC = BC$, being opposite equal angles. Q. E. D.

As this problem is one that has frequently been discussed and is of interest to mathematicians we shall publish, in the June MONTHLY, two or three more of the many excellent solutions we have received. A query from Dr. George Lilley says, "It is said that Mr. I. Todhunter proposed the above problem, and that a direct or *a priori* proof has not been discovered for it. What is the *a priori* proof?—ED.

PROBLEMS.

46. Proposed by GEORGE E. BROCKWAY, Boston, Massachusetts.

If an equilateral triangle is inscribed in a circle, the sum of the squares of the lines joining any point in the circumference to the three vertices of the triangle is constant.

47. Proposed by J. C. GREGG, Superintendent of Schools, Brazil, Indiana.

Given two points A and B and a circle whose center is O: show that the rectangle contained by OB and the perpendicular from B on the polar of A is equal to the rectangle contained by OB and the perpendicular from A on the polar of B.